

“ ... ABSOLUTELY AWESOME  
... EXHILARATING ... ONE OF THE  
BEST VALUES IN AUDIO ... ”

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*“... outstanding ... truly excellent ... sensationally strong performance ... comparable to or better than most speakers two to four times its price ... I analysed a speaker recently at \$20,000 pair that could not nearly duplicate the Studio 100's performance.”*

by Glenn Strauss

#### DESIGN OVERVIEW

Here we have the latest incarnation of a loudspeaker well known to The \$ensible Sound, from a line of speakers well known to me. Our own Joseph M. Cierniak reviewed an earlier version of the Studio 100s and found them to be top-notch performers that epitomize one of the underlying principles of this publication: outstanding products need not necessarily carry stratospheric price tags. My own experiences with Paradigm go back many years; indeed, an inventory of their products in my personal use reveals a pair of Studio 20s, a pair of Studio 60s used as rear surrounds, a Studio center channel used in one of my surround systems, and finally a pair of the awesome Servo-15 subwoofers used in my “A” system. I might add that these were not review units left on “extended loan,” a practice all too common in some audio review circles – every unit was purchased, so you might say I have voted with my dollars.



The Studio 100s arrived in perfect condition, having survived what looked like some rough handling from our friends at UPS. Unpacking them, I was immediately impressed by the significant improvements Paradigm has made over previous incarnations – the new version is visually a giant leap forward. The rather pedestrian, boxy configuration of old has yielded to a smoothly rounded front, a very high quality synthetic laminate sycamore wood finish, and impressive fabrication details. For example, the large, frontal 15" x 3" port is made of cast aluminum, as is the finish panel below it, and the sturdy feet which support this nearly 80-pound loudspeaker. The tweeter is not mounted flat to the front baffle as in previous versions, but rather is extended slightly above the top of the cabinet and integrated into a radiused rubber top plate. This gives a more sophisticated look, and hints at improved radiation pattern performance. Having examined many much more expensive, "boutique" loudspeakers, I was struck by how much value Paradigm packs into this product for the price. A good example is the grill assembly. Where one often sees speakers at four times the price using an MDF frame with some cloth wrapped over it, the Studio 100 has a complex, injection-molded plastic design, shaped to partner with the protruding driver frames to form a seamless, diffraction-resistant unit. As a result, the Paradigm is designed to perform optimally with the grill in place, which is how all my listening and testing was performed. Overall dimensions are 44.5" (113 cm) high x 8.25" (21 cm) wide x 17" (43.2 cm) deep.

*"... easy to integrate ... sounded just great from the get go ... my first impressions were of powerful bass ... extension down to the lowest audible octave ... a crisp, clear midrange ... sparkling highs ..."*

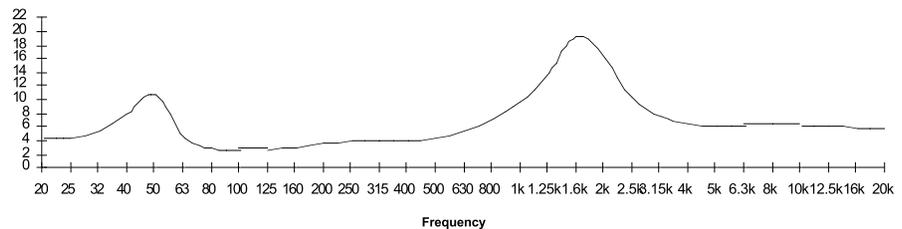
A three-way system priced where many high-end manufacturers only can deliver a two-way, the Studio 100 uses five drivers made entirely by Paradigm. This can be a good thing or a not-so-good thing. If the drivers are well-designed and constructed,

*"... outstanding in the area of pure SPL delivery ... I could drive them shatteringly loud — with no distress ... strong dynamic contrasts ... easily mimicking the fury of a classical orchestra in full stride ... chest-thumping power ..."*

tweeter looks very similar to the previous model, being a 1" (25 mm) aluminum driver with a textile surround. Paradigm indicates that the unit has been refined, however. All the drivers are very well made and have heavy, cast-aluminum frames. One new feature of the Studio 100 is the use of damping material used between the drivers and the front baffle, claiming to "isolate" them from deleterious vibrations.

The crossovers look like classic Paradigm Reference designs, essentially a 2nd-order passive design that couples with the drivers' intrinsic amplitude response to form a 3rd-order electro-acoustic summation. The inductors, capacitors,

Fig. 1 Paradigm Ref. S100 v.3 Impedance Plot Minima: 2.9 ohms @ 105 Hz



not only they can they be optimized for the speaker, they can effect cost savings by eliminating a "value-added" middle supplier. (Most speaker manufacturers buy their drivers from one of the many outstanding Scandinavian specialists, or increasingly, from Pacific Rim suppliers.) In the case of the Studio 100, the drivers are truly excellent, and they differ significantly from the earlier incarnation. Bass and frequencies up to 300 Hz are handled by three 7" (178 mm) mineral-filled polypropylene units. The midrange unit retains the mica-filled design of previous Paradigm Reference units, but has been enlarged from 6.5" (165 mm) to 7" (178-mm) and now sports a very well-finished aluminum phase plug rather than the more common dust cap. It is likely that the phase plug was added to improve off-axis dispersion and offset any effects of going to a larger midrange driver. The low-pass to the tweeter occurs at 2 kHz, lower than many designs, but not as low might be effected with steeper slopes than Paradigm prefers to use. Finally, the

*"... sustained levels far beyond my ability to endure ... this is no pansy, high-end, chamber-music-only pretender ... can really deliver the goods ... terrific sound ... capable of filling any imaginable domestic living space ... output headroom in reserve."*

and resistors are of high quality, and tidily built on printed circuit boards. Although some might question whether this is as "modern" as some competing designs, which may use 4th-order networks, or even very-high-order active designs, the validity of the approach will be determined in my mind by how the speaker sounds and measures.

#### LISTENING IMPRESSIONS

The Paradigm Reference Studio 100s were easy to integrate into my listening room, and ended up sounding best in a

location nearly identical to other forward-radiating vented loudspeakers with front-mounted ports. This was about four feet from the front wall, three feet from the sides, about eight feet apart, and eight feet from the listening position, which is well away from the back wall to minimize comb-filtering effects. Since many folks are concerned about having speakers well out in the room, I also experimented with placing them much closer to the front wall, and other than some extra heft in the bass, the overall quality of the sound did not deteriorate. So these speakers offer location flexibility lacking in some other designs.

I tried two amplification sources with the Studio 100s. To match a sensible amplifier of typical power output, I first used my trusty Parasound HCA-1000a, rated at 125 wpc into 8 ohms and well over 200 wpc into 4 ohms. The Paradigms sounded just great from the get go – my first impressions were of powerful bass with in-room extension down to the lowest audible octave, a crisp, clear midrange, and sparkling highs with a hint of extra sheen, a characteristic of every Paradigm tweeter I have encountered. However, I found the new tweeter to be a lot smoother overall than the first Studio tweeter and a bit smoother overall than the last Studio tweeter. (This was later confirmed when I measured all three under similar conditions).

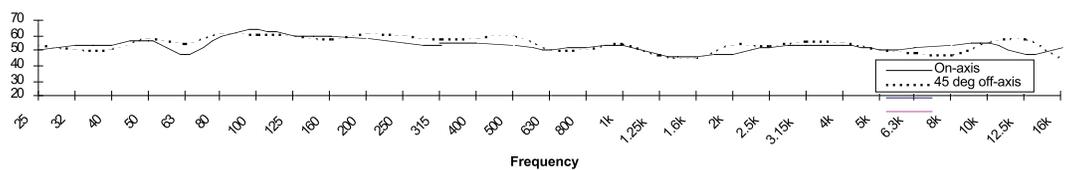
*“... pleasingly rendered ... exemplary on and off-axis smoothness ... convincing center fill and L/R channel delineation ... had the ability many other loudspeakers in this price range, or often much higher, do not — to figuratively disappear ... made it challenging to identify the source of the music ... Paradigm certainly has its network and drivers dialed in expertly.”*

The Studio 100s have always been outstanding in the area of pure SPL delivery, and these new ones did not disappoint – I could drive them shatteringly loud with the Parasound amp with no distress from the speakers. They provided strong dynamic contrasts, easily mimicking the fury of a classical orchestra in full stride, or the chest-thumping power of something like Pink Floyd’s “Dark Side of the Moon.” Just for fun and out of curiosity as to whether they had anything left, I then teamed them with my InnerSound ESL amp, which is capable of 600 wpc into 4 ohms. They easily endured a heavy hand on the throttle, playing at sustained levels far beyond my ability to endure – let’s just say that this is no pansy, high-end, chamber-music-only pretender. The

of the music. Paradigm certainly has its network and drivers dialed-in expertly, so perhaps there is something to be said for their sticking with their traditional filtering designs.

Tonal balance was very good, with a bit of extra energy apparent in the upper bass/lower midrange region and a bit more sparkle in the top two octaves than I am used to hearing in the concert hall, or from my reference loudspeakers. That is not to say that they were boomy or shrill – no, not at all. Music was delivered with a power in the deepest bass and excellent airiness, but with both ends slightly standing out from the midrange frequencies. (This may or may not have been intentional, as we often see loudspeakers with some shelving down in

Fig. 2 Paradigm Ref S100 v.3 Horizontal in-room pink noise 1/3 octave RTA @ 2M (C-wtd, continuous avg.)



Paradigm Studio 100’s can really deliver the goods – terrific sound capable of filling any imaginable domestic listening space with output headroom in reserve. Try that with one of those much more expensive 1st-order 2-ways that seem to be the darlings of other publications – they will take their buzzing tweeters and smoking woofers and run and hide when the Big Dog Studio 100 comes a callin’.

The soundstage was very pleasingly rendered. The Studio 100’s had exemplary on and off-axis smoothness, passing the “stand-up/sit-down” test much better than many other speakers. This bodes well for use as an entertainment instrument, whether to provide background for guests milling about the room, or for music or home-theater use, where convincing center fill and L/R channel delineation will make for happy campers at the far ends of the couch. This speaker had the ability many other loudspeakers in this price range, or often much higher, do not – it had the ability to figuratively disappear, so that closing one’s eyes tended to support an experience that made it challenging to identify the source

the mid-frequencies; psycho-acoustically, this has been shown to provide a greater sense of depth to forward-radiating loudspeakers, a characteristic many audiophiles prefer or even demand.)

What a fine midrange this version had! In my opinion, this is unquestionably the greatest improvement over the earlier versions. I did level-matched and position-consistent A/B comparisons of this version and the previous version of midrange drivers, and found this one to have better clarity, dynamics, and off-axis smoothness, while being able to play as loud as I could ever want. The sense of power and extension in the bass was exceptionally good – the Studio 100s were capable of reaching very deep with extraordinary output and clarity – no subwoofer is required here! Terrific job, Paradigm.

As a final test of home theater potential, I partnered the Studio 100’s with two Paradigm Reference Servo-15 subwoofers, crossed over at 50 Hz, 3rd-order low-and high-pass. I then put on some of the traditional demonstration disc

wonders: Organ favorites, Stravinsky's *Firebird*, Apollo Saturn rocket launches, and Sir Mix-A-Lot took on exhilarating and often frightening proportions. Absolutely awesome.

#### MEASUREMENTS

Although I am only displaying three graphics in this review, I ran more than 20 tests. Readings of the work of Dr. Floyd Toole and Sean Olive, others from Mark Davis combined with correspondence from fellow T \$S'ers David Rich and David Moran (The Two Davids?) have led me to search for a measurement paradigm that combines the theoretical perfection of quasi-anechoic measurements with the real-world applicability of in-room testing. Both camps have validity, so I have decided to develop a hybrid methodology. When possible, I will continue to do outdoor ground-plane quasi-anechoic measurements, near field measurements of bass response using Don Keele's protocol, THD+N and impedance analysis, 1/12 octave FFT measurements, and in-room, 1/3 octave RTA using uncorrelated pink noise and weighted, continuous averaging of the stereo pair in a typical room location. I look for either consistency, or something that indicates a possible design flaw or compromise.

***"Tonal balance was very good ... power in the deepest bass ... excellent airiness ... a fine midrange ... sense of power and extension in the bass was exceptionally good ... able to play as loud as I could ever want ... capable of reaching very deep with extraordinary output and clarity."***

In the case of the Studio 100s there was a consistency in all the measurements that made me feel comfortable that my graphics fairly represented the overall performance capability of this loudspeaker. Let's first look at impedance (Figure 1, on page 2). Although rated as a 4-ohm speaker, notice

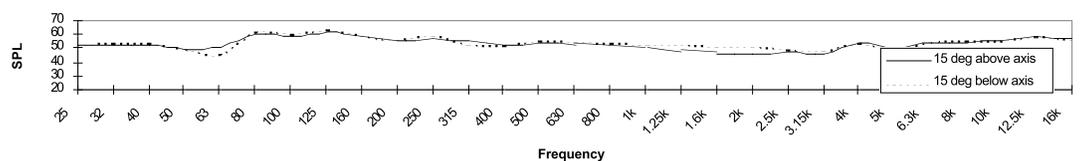
how the lower bass, and much of the midrange "musical power corridor" is at 4 ohms or below, reaching a minima of 2.9 ohms at about 105 Hz. Combined with a less than ideal phase angle, the Studio 100s will need an amp capable of good current delivery, especially if you listen at loud levels for sustained periods of time. Recall, though, that the sub-\$600 Parasound drove them loudly with no complaints, and today's better receivers are also capable of doing so.

Next, let's look at sensitivity. Paradigm specs "91 dB in-room" with no impedance specified. Given that I measure sensitivity at octaves on either side of 400 Hz, and the impedance measured 4 ohms in those regions, I would rate the Studio 100 at 88 – 89 dB sensitivity. But in the end, the

signal down to 1 Hz! While of course this provided no practical benefit, it was fun to watch the woofers moving dramatically once per second! More importantly, it speaks to the physical integrity of the entire product as well as the woofers – even when faced with this offensive demand, there were no rattles, port noise, or misbehavior whatsoever. This speaker is obviously very solidly engineered and built.

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Fig. 3 Paradigm Ref S100 v.3 Vertical in-room pink noise 1/3 octave RTA @ 2M (C-wtd, continuous avg.)



performance and output capability of the Studio 100 makes the matter more academic than practical.

I like to perform extensive tests of a loudspeaker's bass design, and here the Studio 100 provided nearly textbook system design. This vented system is just about perfect; the minimum excursion point of the woofers indicated a very low port tuning frequency of about 20 Hz or so – this will certainly explain the Studio 100s prodigious bass performance. The three 7" (178 mm) woofers per speaker have generous peak-to-peak excursion, helping deliver the output capability cleanly. I set my signal generator to fine mode, and was able to step the bass down 1 Hz at a time. Often, I will see the woofers stop moving altogether, which can mean there is a series capacitor acting as a high-pass somewhere in the lowest bass range. While this can prevent overload, it also can add a reactance to the load the amplifier sees, which may or may not make the amplifier happy. In the Studio 100, I was able to take the

The overall amplitude response of the Studio 100 was determined with over ten separate tests, but as mentioned earlier, I found that two graphics were sufficient to present the overall profile of the Studio 100. (Figure 2, page 3) shows the in-room horizontal RTA using continuous, weighted averaging. Note that I moved the microphone to do the off-axis measurement, rather than the loudspeaker – this largely explains the apparent inconsistent lower bass response, but I believe it more closely approximates the effects of overall room power response, to which the off-axis radiation pattern contributes. The overall response shows a very smooth on-axis response. There is a broad rise in the upper bass/lower midrange that leads gradually to a shelving in the 1 – 3 kHz range, a return to reference level over most of the range, with some peaking in the 10 kHz range, and a shallow roll-off in the frequencies above 16 kHz. (The 63 Hz dip in both curves indicates a room mode and should be ignored.) But note how the

45-degree off-axis curve tends to offset some of the amplitude variations on-axis. So while my general impressions of the speaker noted earlier are supported by the measurements, the overall in-room supports my comments that this speaker is essentially neutral, neither boomy nor brassy.

***“As a final test of home theater potential I partnered the Studio 100’s with two Servo-15 subwoofers ... Organ favorites — took on exhilarating and often frightening proportions ... Absolutely awesome.”***

(Figure 3, page 4) looks at the vertical off-axis response. Folks, this is about as good as it gets. Many loudspeakers show very bad vertical response above axis, with a substantial suck-out at the crossover to the tweeter. Conversely, if one were to average the Studio 100s two curves, they would pretty well null out, leaving only a very smooth overall vertical output performance. Again, this displays excellent filter network design and integration with the drivers. Applying a bass step, I determined that the midrange and tweeter drivers are electrically phase-inverted, while the woofers are positive. However, Paradigm’s engineers have done their homework, as the summation of all the variables has resulted in an outstanding result.

I ran some other tests to examine the new driver’s compared to previous Studio Series units. I found that indeed, the midrange driver was much flatter and smoother than previous versions; conversely, I did not find the tweeter’s overall response to be significantly better than in the previous version, but much better than the original version, which sounds too bright on my Studio 20s.

As far as distortion is concerned, I only measure bass distortion these days, as I have not found midrange and tweeter units these days to distort significantly — the audio industry seems to have resolved that issue for good. My distortion test is

standardized at 63 Hz, as this is right in the bass power zone, a frequency most “full-range” loudspeakers can reproduce. I measure THD+N at 1 meter. The Studio 100 had a low 0.89% at 90 dB SPL, rising to 7.25% at 95 dB. This is very good performance.

The Studio 100 really stretched my ability to determine its ultimate output capability. Usually, I can bring a speaker to its knees at somewhere above 108 dB/1M with pink noise or musical passages, but not the Studio 100. It was still going strong at 112 dB, but the Parasound amplifier began to give out. Switching to the more powerful InnerSound, I was able to get 115 dB, with hearing protection! I am not sure what the ultimate output of the Studio 100 really is, as this is sensationally strong performance, and exceeds the capability of any speaker I have ever owned. I also do not like to send products back to the manufacturer with melted voice coils.

***“Terrific job, Paradigm ... An outstanding performer ... certainly one of the best values in audio today ... Combine its deep bass performance, midrange clarity, and treble sparkle with exceptional placement flexibility ... a winner for both music and home theater ... Highly recommended.”***

#### CONCLUSION

The Paradigm Reference Studio 100 is an outstanding performer overall, and certainly one of the best values in audio today. The speaker that The \$ensible Sound reviewed previously has been taken uptown in both its appearance and performance, and is now comparable to or better than most speakers 2 to 4 times its price. Indeed, I analysed a speaker recently at \$20,000/pair that could not nearly duplicate the Studio 100’s performance, in the listening room or the lab! Combine its deep bass performance, midrange clarity, and treble sparkle with exceptional placement flexibility, and you have a winner for both music and home-

theater applications. Although I still would prefer a more neutral amplitude response from Paradigm, and prefer the overall sonic picture that my dipoles offer, the Studio 100 is a testament to how far the art of forward-radiating speaker engineering has come. One of the standards I use to assess a loudspeaker is — “Could I live with it?” In the case of the Paradigm Reference Studio 100, the answer is a resounding, “Yes indeed!” Highly recommended.